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# A COMPREHENSIVE REVIEW ANALYSIS ON FACE SKIN CANCER USING MACHINE LEARNING TECHNIQUES

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## ABSTRACT

One of the most significant issues on the planet is the identification of skin cancer. In order to effectively treat skin cancer, early identification and diagnosis are crucial. Now Machine learning can be used to detect skin cancer as artificial intelligence in healthcare and diagnosis has advanced significantly. Images have always played a pivotal role in human life because vision is the most significant sense of human beings. Due to the fact, image processing has plenty of applications in the field of agriculture, military, security, medical, etc., Machine learning is the only method of data analysis that automates analytical model building by identifying patterns and making decisions with minimal human interference. Machine learning acts as an integral component of intelligent computer vision systems when such adaptation is required. The recent advancements in the field of 'Machine Learning' open up a new opportunity to develop intelligent computer-controlled machines and software. The prime aim of this review is to assist pathologists by proposing a proficient and accessible automated diagnosis system for facial skin cancer. The system must capable to discriminate face skin cancer as benign or malignant in conjunction with the classification of lesions in sub-ordinate classes of benign and malignant to determine the location of cancer.

**Keywords**: Face skin cancer; Machine learning; Transfer learning; Dermascopic images; Pathologists.

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## INTRODUCTION

Skin cancer is one of the most deadly and common illnesses that commonly affects people. The two most common types of skin cancer that affect people are melanoma and non-melanoma. The most dangerous and deadly form of skin cancer is melanoma, which has a high mortality rate and an overall affecting case rate of less than 5%. The prevalence of melanoma cases was also projected by the World Health Organisation. Self-examination of the skin and clinical examinations of the skin are the traditional methods for identifying skin cancer. However, these inspection methods are quite difficult and time-consuming. This method is very expensive and requires a lot of patient visits. Further more, specific tools like laser-based tools and microspectroscopic equipments are required for these testing. It requires labour and substantial training to operate. (1)

People can now diagnose skin cancer by uploading a photograph over their phone thanks to the smartphone revolution. However, these images could not be of professional calibre, which could lead to a misdiagnosis. Additionally, sharing on the internet could compromise privacy. However, as AI has advanced, daily interactions between humans and AI have increased, which could aid physicians in making wiser choices.(2)

In Addition to this, the usage of AI will lessen diagnostic human mistake. Despite the existence of such AI technologies, a skilled physician is still necessary. The purpose of this study is to investigate the application of CNN and deep learning to the early identification of skin cancer. Here, A model is trained using the data available for skin cancer, and the model's accuracy improves with each new set of training data.(3)

This uses deep learning and deep multi-layered networks instead of multilayer neural networks, which require training on very large data sets to increase the accuracy of the system. These AI skin cancer detection techniques are incredibly accessible, user-friendly, and inexpensive. Furthermore, AI-based technology has been oversimplified and provides much more drawbacks and features than traditional methods of skin cancer screening. The image is fed to the model, which then processes it to classify the type of skin cancer. This is how skin cancer is detected using AI. The subject of AI has undergone a revolution. Thanks to deep learning. Transfer learning is used instead of previously trained model for greater accuracy. Deep learning algorithms draw their inspiration from the human brain. The outcomes of AI and machine learning have improved. Thanks to deep learning. This study does a review of the literature on various traditional deep learning techniques used for skin cancer diagnosis and their methodology. In order to obtain the most enhanced results utilising CNN, a brand-new model is created in this paper. Vgg-16, Mobilenet, and Inception V3 are employed as surface models. Thus, compared to the traditional methods of detection, this model for skin cancer detection has made diagnosis and detection easier. (4)

### Cancer and its molecular basis

Unnatural cell proliferation has been linked to a group of diseases known as Malignancies. In the absence of treatment, the condition can worsen and finally cause early death. They can manifest everywhere in the body and affect people of all ages, socioeconomic levels and races. Cancer is the leading cause of morbidity and mortality worldwide. According to data from the International Agency for Research on Cancer, there were 326 lakh cancer survivors worldwide in 2012 and 141 lakh new instances of the disease. About 4.7 lakh new cases of cancer are discovered in our own country each year. Each year, more than 3.5 lakh people die from cancer in India alone. (5)

Cancer is defined as uncontrolled and unrestrained cell proliferation. It appears as a growth in a clinical context. A malformed mass of tissue known as Neoplasm, grows erratically and keeps growing long after the factors that first triggered its growth have been removed.When a tumour is considered to be relatively harmless, it usually means that it won't spread to neighbouring or distant regions, can be surgically removed without difficulty, and doesn't pose a significant risk to the patient's life. Malignant tumours are collectively referred to as cancers, which is derived from the Latin word for crab, because they have a crab-like effect on the tissues. A malignant tumour has the capacity to

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"metastasize" (spread to other locations), damage adjacent structures, and ultimately cause death. With the proper diagnosis and treatment, not all cancers are fatal; some tumours can be cured. (6)

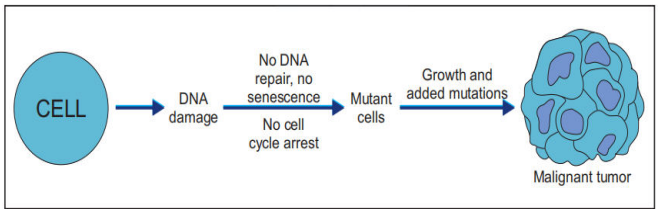


**Figure 1: Simplified depiction of how a cell undergoes malignant change – with DNA damage, no repair and further mutations**

**Face skin cancer**

**Squamous cell carcinoma**

The second most typical SCC occurs in the squamous layer of the skin's corneum and mucous membranes. There is no pearly shaft surrounding the change, and the SCC has increased virulence (grade I–IV) in accordance with the number of grown cells.

Early squamous cell carcinoma of the skin, sometimes known as a "carcinoma in situ," is indicated by a highly restricted red erythema. Advanced lesions are occasionally ulcerative, nodular, and have papillary hyperkeratosis. The base and embankment edge changes caused by infiltration, the lack of a pearly, translucent appearance, and the severity of the telangiectasia are differentiating features. (7)

It usually appears in the bottom part of the face, below the dividing line between the lobe of the ear and the corner of the mouth. It stands out for having a fast rate of growth and a propensity to metastasize (3-5%), which rises to 30% for sites close to the borders of the skin and mucous membranes or for local recurrence. For a diagnosis, a histological investigation is necessary. Samples can be taken using excisional biopsy, shear biopsy, fragmentation biopsy, or lymph node biopsy techniques. (8)

There are two types of SCC:

• Exophytic form (Type I) is characterized by the occurrence of ulcers and late metastasis,

• Endophytic form (Type II) is growing faster than ulcerative, metastasizing faster to lymph nodes (85%) or distant (15%).

The SCC grade of differentiation also depends on the individual cell structures and the tendency to keratinization.

To evaluate the four-grade scale of Broders is used (undifferentiated cells to evaluate the amount of the entire tumor mass)

**Pathophysiology**

The second most frequent kind of skin cancer in the United States, after basal cell carcinoma, is squamous cell carcinoma of the skin, also known as cutaneous squamous cell carcinoma. Squamous cell carcinoma has precursor lesions known as actinic keratoses, which spread throughout the body and displays tumour growth. The main risk factor for the development of cutaneous squamous cell carcinoma is UV solar radiation and lifelong exposure to UV radiation has a substantial impact on the formation of this malignancy. The main form of treatment for cutaneous squamous cell carcinoma is surgical excision. For squamous cell carcinomas of the head and neck, as well as other high-risk regions or squamous cell carcinomas with high-risk characteristics, Mohs micrographic surgery is the preferred excisional approach. Radiation therapy is only used to treat squamous cell carcinoma in elderly patients, those who won't tolerate surgery, or in cases where clear margins couldn't be established during surgery. After surgical treatment, adjuvant radiation is frequently used in cancers with significant tumour load. The likelihood of developing squamous cell carcinoma throughout the course of one's lifetime is markedly increased by immune suppression. Although it is possible, squamous cell carcinomas that develop in areas exposed to the sun for an extended period of time seldom metastasize, and the risk is higher in individuals who are immune suppressed. Patients who have cutaneous squamous cell carcinoma should have routine examinations and use caution around UV rays. (9)

Most experts concur that UV exposure is the main risk factor for skin squamous cell carcinoma. The genetic anomalies most frequently observed in actinic keratosis, in situ squamous cell

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carcinoma, and invasive squamous cell carcinoma are p53 gene mutations. Tanning beds, therapeutic UV rays and ionising radiation exposure are well known risk factors for the development of squamous cell carcinoma, most likely via the p53 pathway. The p53 protein prevents the proliferation of cells with damaged or mutant DNA. The p53 protein is rendered useless if the p53 gene is altered in the manners described above. As a result, cells with damaged DNA, such as those found in squamous cell carcinoma, can multiply. (10)

**Related works**

Dr. Abbas Hannon, Alasadi Baidaa M.ALsafy claims that an image processing technology is utilised to diagnose melanoma at an early stage. Here, two procedures must be carried out: the first to determine whether a pigment skin lesion is benign or malignant and the second to identify the skin type of malignant melanoma. Lesion segmentation and feature extraction then continue the process. To distinguish between benign and malignant melanoma, a diagnosis is made. As a result, it may result in many types of malignant melanoma, including lentigo, superficial, nodular, and acral melanoma. (11)

According to Sanjana M and Dr. V. Hanuman Kumar, this essay focuses on identifying skin cancer that is brought on by one of the circumstances stated above. To determine the cancer stage, the photos are analysed using a combination of machine learning and image processing. Derma scope is used to take pictures of the affected area. Skin cancer detection algorithms have been devised, although the majority of the inputs are fed manually. The major goal of this research is to create a machine learning algorithm that needs little human involvement. (12)

Here, we offer a variety of skin cancer screening techniques. Several procedures, including pre-processing, segmentation, classification and feature extraction, must be followed in order to detect melanoma. This paper focuses on a variety of techniques, including hybrid artificial neural networks, genetic algorithms, neurofuzzy systems, SVM, CNN, ABCD rules and unsupervised algorithms like the K means algorithm. However, the SVM algorithm technique outperforms all other examined algorithms for cancer detection because it has the least drawbacks. We conclude that, the neural network technique is the best out of all the systems now in use. Nikitha Kaut, Aayush Shah, and Shali Vira Harmit Sampat contributed this information. (13)

Dermoscopy, according to Hao Chang from the Department of Genetics at Yale University School of Medicine, is one of the most crucial methods for examining skin lesions because it can take high-resolution pictures of the skin while avoiding interference from surface reflections. This high-resolution imaging is used by particularly skilled professionals to assess the risk of melanoma from the very beginning and can produce a diagnostic accuracy of up to 80%. But there aren't enough qualified dermatologists in the entire planet. The academic research community has made efforts to develop machine-driven image analysis software to categorise various skin-associated disorders using Dermoscopy pictures to address this issue. (14)

Munya A. Arasi, El-Sayed A El-Dahshan, El-Sayed M. El-Horbaty and AbdelBadeeh M. Salem have focused on an overview of recent states of the art in Computer-aided detection/diagnosis (CAD) systems in identifying and diagnosing malignant melanoma of Dermoscopy images and describe its steps starting with image acquisition, preprocessing and finishing with malignant melanoma classification of Dermoscopic images. (15)

The comparative study shows that the most common methods for features extraction are the Discrete Wavelet Transform (DWT) and the method which combines both texture and color features resulting in output of very high accuracy. The methods for the classification are Nearest Neighbor, Artificial Neural Networks, and Support Vector Machines are very well. (16)

**DIAGNOSTIC TOOLS**

**THE ABCD RULE:**

Stolz developed ABCD rule, which doctors use to detect skin lesions and determine

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whether a pigmented lesion is likely to be cancerous. Along with its calculating speed, this method can offer a more accurate and repeatable identification of skin malignancies. Based on four factors are:(A) stands for ASYMMETRY, which is when a mole or birthmark has two halves that aren't equal in size. The lesion is bisected by two orthogonal axes. Asymmetry is evaluated for both axes in terms of shape, colour, and/or dermoscopic features. If there is asymmetry on both axes, it receives a score of 2, a score of one on one axis, and a score of zero on the other.(B) stands for BORDER: The borders are ragged, blurry, uneven, or notched.The letter (C) stands for colour, and it may have varying tones of brown or black, as well as spots of other colours like red, white, or blue. The six colors—white, red, light brown, dark brown, blue-gray, and black are what we search for. For each colour already in existence, the score is increased by one.(D) stands for DIAMETER, which refers to a size that is greater than or expanding beyond 6 millimetres (approximately 14 inch, or the size of a pencil pencil). (17)

To calculate the final score (Total Dermoscopy Score – TDS) the following formula is used: TDS = [(A score × 1.3) + (B score × 0.1) + (C score × 0.5) +(D score × 0.5)]

**Image processing**

- Image processing is a method for converting a picture into a sophisticated structure. In this kind of processing, the information would be visual, such a photograph or video captured with a camera.
- The purpose of processing is to identify various trademarks and other factors in a photograph.
- When preparing strategies, use standardised sign handling techniques and a graphic of a 2D signal.
- An enhanced picture holding comprises computerised information adjustment for picture quality improvement under PC guidance.
- The treatment improves the image's quality, sharpness, and details, igniting interest in data extraction and further investigation.
- Processing is done with the intention of observing objects that are not visible and improving subsequent images.

**Steps in Image Processing**

**Image Acquisition:** The image is acquired, and then it is processed using a number of methods. In other terms, image acquisition can also refer to the process of reading an image from a source. (18)

**Image Pre-processing:** The appropriate colour model must be selected for the image being processed in this step. The primary objective of image pre-processing is frequently to improve certain visual characteristics that are essential for additional processing while suppressing undesired distortions in the image data. (19)

**Image segmentation:** Using sets of numerous different pixels, image segmentation is a technique for breaking up a digital image into various pieces. The main purposes of segmentation are to streamline and increase the value of a particular representation in an image. It usually makes it simpler to locate objects and boundaries, such as edges, curves, and lines, among others. This problem is solved by creating a mask that matches the hue of the background to that of the affected area. If not, the computer can wrongly think the background is where the skin cancer is located. During this process, caution must be exercised. (20)

**Dilation:** This method of morphological operation thickens the object in any binary image. The amount and direction depend on the size and shape of the structure's component. Dilation is accomplished using the imerode MATLAB function. A visual element and a structural element are included in the parameters. (21)

**Erosion:** Erosion is another morphological process that reduces the size and thickness of objects in the image. The specific amount and range of this thinning are determined by the form and size of the structural component. Morphological erosion is carried out in MATLAB utilising imerode by function. The picture and the structuring element are among the variables. (22)

**MACHINE LEARNING**

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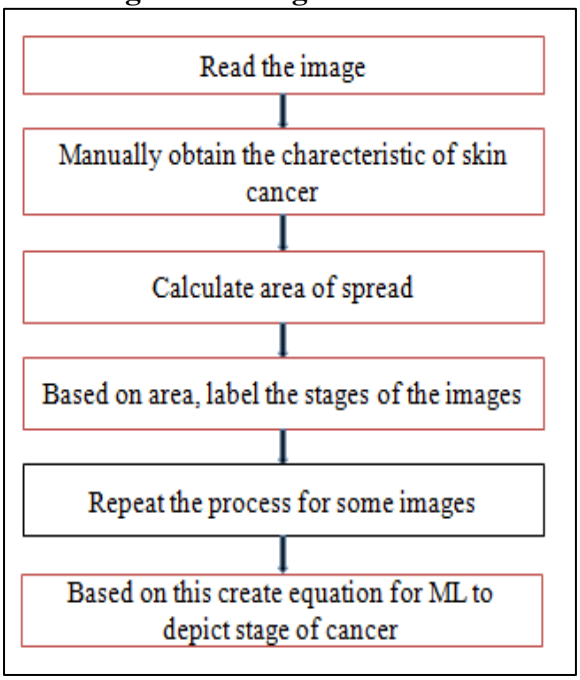
In machine learning, there are two different modes namely training mode and test mode.

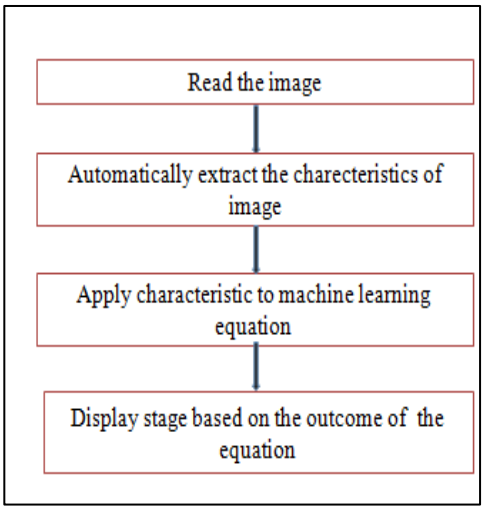
**Part A: Training mode**

**Fig . 1 Training mode**




**Part B: Test mode**

**Fig.2 Test mode**




**Histogram**

A histogram is a real-world information presentation that uses lines to show how data items repeat themselves in dynamic numerical intervals of the same size. A histogram is a graph of data that employs bars of varied widths to depict the data. On a smaller scale, it is used to condense reliable or discrete facts. Since there are never any openings between the bars when the components are limitless, spaces should always be left between the bars in discrete circumstances. On the basis of the histogram, we get the mean value (M). The proper equation for displaying the output using the mean value must now be chosen. (23)

After testing many equations, we can say that cubic regression works well for presenting the outcome.

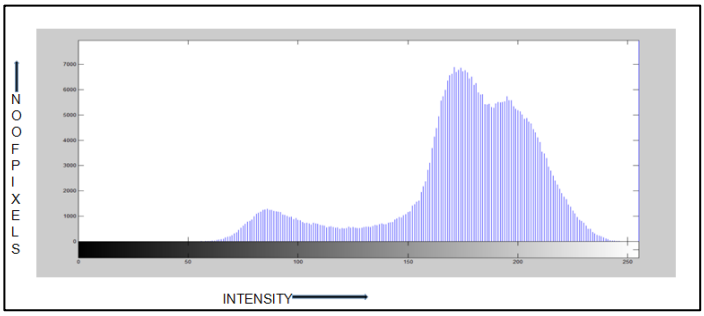



**Fig.3 Histogram Curve**

**CONCLUSION**

A medical method, as opposed to physically checking a lesion, is more accurate yet takes longer to detect skin cancer. To correctly segment lesions in dermoscopy samples is both necessary and challenging. In order to complete these jobs more skillfully, an automated computer-aided diagnosis system is used. This in-depth research work has covered a variety of non-invasive machine learning and deep learning methods for identifying and categorising skin cancer. The skin cancer recognition system needs to go through a number of steps, including pre-processing, segmentation, feature extraction, and classification. This survey's main emphasis was on the most recent methods for finding skin cancer. The best course of action is to carefully select an algorithm based on the situation because every algorithm has benefits and drawbacks of its own.

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